CHAPTER 1

Introduction

The Catalyst 2900 series XL switches are workgroup Ethernet switches that supply autosensing 10BaseT or 100BaseT connections on all ports. These switches–also referred to as the Catalyst 2900 series–can be deployed as backbone switches aggregating 100BaseT traffic from other switches and hubs or in mixed configurations connecting hubs, switches, servers, and desktops.

This chapter is a functional overview of the Catalyst 2900 series. The following topics briefly describe the components and features that are shared by all switches in the series:

- Summary of key features
- Descriptions of the front and rear panels
- Software and management options for the switches
- Examples of the Catalyst 2900 series in different network topologies

Summary of Key Features

The Catalyst 2900 series XL switches are members of an extended network system of stackable, modular LAN and WAN products that increase LAN performance, connect remote offices and users, and provide secure access.

Figure 1-1 shows the five versions of the Catalyst 2900 series, and Table 1-1 lists their key features.

Table 1-2 lists the Cisco IOS Release 11.2(8)SA4 software that can run on the current and legacy Catalyst 2900 series XL switches and modules.

Figure 1-1 Catalyst 2900 Series XL Switches

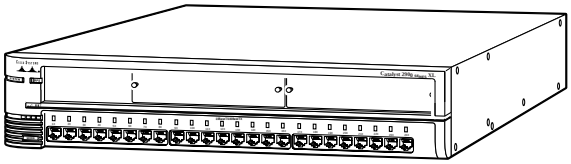
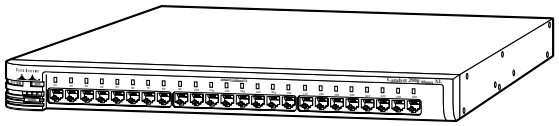
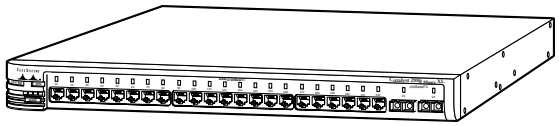
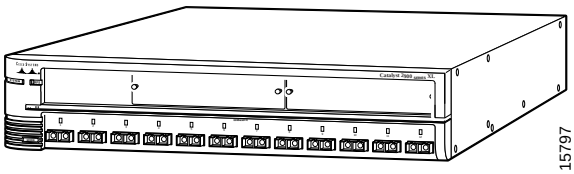
Model Number	Description	Switch
WS-C2912-XL-A WS-C2912-XL-EN	12 fixed autosensing 10/100 ports	
WS-C2924M-XL-A WS-C2924M-XL-EN	24 fixed autosensing 10/100 ports 2 high-speed expansion slots	
WS-C2924-XL-A WS-C2924-XL-EN	24 fixed autosensing 10/100 ports	
WS-C2924C-XL-A WS-C2924C-XL-EN	22 fixed autosensing 10/100 ports 2 100BaseFX ports	
WS-C2912MF-XL	12 100BaseFX ports 2 high-speed expansion slots	

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Table 1-1 Summary of Key Features

Feature	Description
Performance and Configuration	• Autonegotiation of speed and half- or full-duplex operation on 10/100 ports • Support for up to 64 port-based VLANs • Two high-speed expansion slots support 10BaseT/100BaseTX, 100BaseFX and Gigabit Ethernet modules (Catalyst 2924M XL and Catalyst 2912MF XL only) • Inter-Switch Link (ISL) and IEEE 802.1Q trunking support on all ports (Enterprise Edition software only) • EtherChannel support for high-speed connections between switches and servers • Support for 2048 MAC addresses on Catalyst 2924 XL, 2924C XL, and 2912 XL models • Support for 8192 MAC address on Catalyst 2924M XL and 2912MF XL • IEEE 802.1d Spanning-Tree Protocol support on a per-VLAN basis • Supported by Cisco IOS Release 11.2(8)SA4 • Cisco Group Management Protocol (CGMP) to limit the flooding of IP multicast traffic • Full-duplex operation on all 100BaseFX ports • Port security to prevent unauthorized access to the network • Switched Port Analyzer (SPAN) port monitoring on any port • Broadcast storm control to prevent performance degradation from broadcast storms • Four groups of embedded Remote Monitoring (RMON)
Management	• Embedded web-based interface for most management tasks • Cisco Switch Network View feature to display network topology and Catalyst 2900 series visual stack • Cisco IOS CLI via the console port or Telnet • CiscoView device-management application
Redundancy	• Connection for optional Cisco 600W AC redundant power system (RPS) as a backup

Catalyst 2900 Series XL Switches and Modules

Table 1-2 Catalyst 2900 Series XL Switches and Modules

Model Number	Description	Cisco IOS 11.2(8)SA4 (-A)	Cisco IOS 11.2(8)SA4 (-EN)	Trunking Ports?
	Switches			
WS-C 2912-XL-A WS-C2912-XL-EN	12 fixed autosensing 10/100 ports	Yes	Yes	Yes (-EN)
WS-C2924M-XL-A WS-C2924M-XL-EN	24 fixed autosensing 10/100 ports and 2 high-speed expansion slots	Yes	Yes	Yes (-EN)
WS-C2924-XL-A WS-C2924-XL-EN	24 fixed autosensing 10/100 ports	Yes	Yes	Yes (-EN)
WS-C2924C-XL-A WS-C2924C-XL-EN	22 fixed autosensing 10/100 ports and 2 fixed 100BaseFX ports	Yes	Yes	Yes (-EN)
WS-C2912MF-XL	12 100BaseFX ports and 2 high-speed expansion slots	No	Yes	Yes
WS-C2908-XL	8 fixed autosensing 10/100 ports	No	Yes	No
WS-C2924-XL	24 fixed autosensing 10/100 ports	No	Yes	No
WS-C2924C-XL	22 fixed autosensing 10/100 ports	No	Yes	No
WS-C2916M-XL	16 fixed autosensing 10/100 ports and 2 high-speed expansion slots	No	Yes	No[1]
	Modules			
WS-X2914-XL-V	4 autosensing 10/100 UTP ports	Yes	Yes	Yes
WS-X2922-XL-V	2 100BaseFX ports	Yes	Yes	Yes
WS-X2924-XL-V	4 100BaseFX ports	Yes	Yes	Yes
WS-X2914-XL	4 autosensing 10/100 UTP ports	Yes	Yes	No
WS-X2922-XL	2 100BaseFX ports	Yes	Yes	No

1 Module ports that support trunking can be installed in this switch if the switch is running Cisco IOS Release 11.2(8)SA4 Enterprise Edition Software.

Front-Panel Description

This section describes the switch ports, the expansion slots and their modules, and the LEDs on the switch front panel.

10/100 Ports

Catalyst 2900 series 10/100 ports are internally switched to all other switch ports and use RJ-45 connectors and Category 5 cabling. They can operate at either 10 or 100 Mbps in full or half duplex. For autonegotiation with other devices, the ports are IEEE 802.3u-compliant.

When connected to another device, a port senses the speed and duplex settings of the attached device and advertises its own capabilities. If the connected device also supports autonegotiation, the Catalyst 2900 series port negotiates the best connection and configures itself accordingly. Ports can also be explicitly set to operate in any combination of half duplex, full duplex, 10 Mbps, or 100 Mbps. In all cases, the attached device must be within 100 meters of the switch.

100BaseFX Ports

The Catalyst 2924C XL switch (see Figure 1-2) has two 100BaseFX ports, and the Catalyst 2912MF XL has twelve 100BaseFX ports. These ports use 10/125- or 62.5/125-micron multimode fiber-optic cabling. In the default full-duplex mode, these ports can connect to other 100BaseFX devices over distances of up to 2 kilometers. In half-duplex mode, the ports support connections to devices up to 412 meters from the switch.

The 100BaseFX ports default to full-duplex operation and do not autonegotiate.

High-Speed Expansion Slots

The Catalyst 2924M XL and the Catalyst 2912MF XL models (see Figure 1-2 and Figure 1-3) have two high-speed expansion slots for the Catalyst 2900 series XL hot-swappable modules. Each module port is internally switched to all other Catalyst switch ports and is managed through the switch management interfaces.

The Catalyst 2900 series XL modules automatically configure themselves when you insert them in expansion slots and tighten the thumb screws. A power-on self-test (POST) verifies that the module is working properly before it starts forwarding packets.

Modules WS-X2914-XL and WS X2922-XL support 2048 MAC addresses. If you install one of these modules in a 2924M XL or Catalyst 2912MF XL, which support 8192 MAC addresses, the module will fail POST. You can start the module by restarting the switch with the module installed. After the restart, the addressing capacity of the switch is reduced to 2048 MAC addresses.

Modules WS-X2914-XL-V, WS-X2922-XL-V, and WS-X2924-XL-V support 8192 MAC addresses. If you install one of these modules in a Catalyst 2916M XL model, which supports 2048 MAC addresses, the module reduces its address capacity to 2048 MAC addresses.

Figure 1-2 100BaseFX Ports: Catalyst 2924C XL and Catalyst 2912MF XL

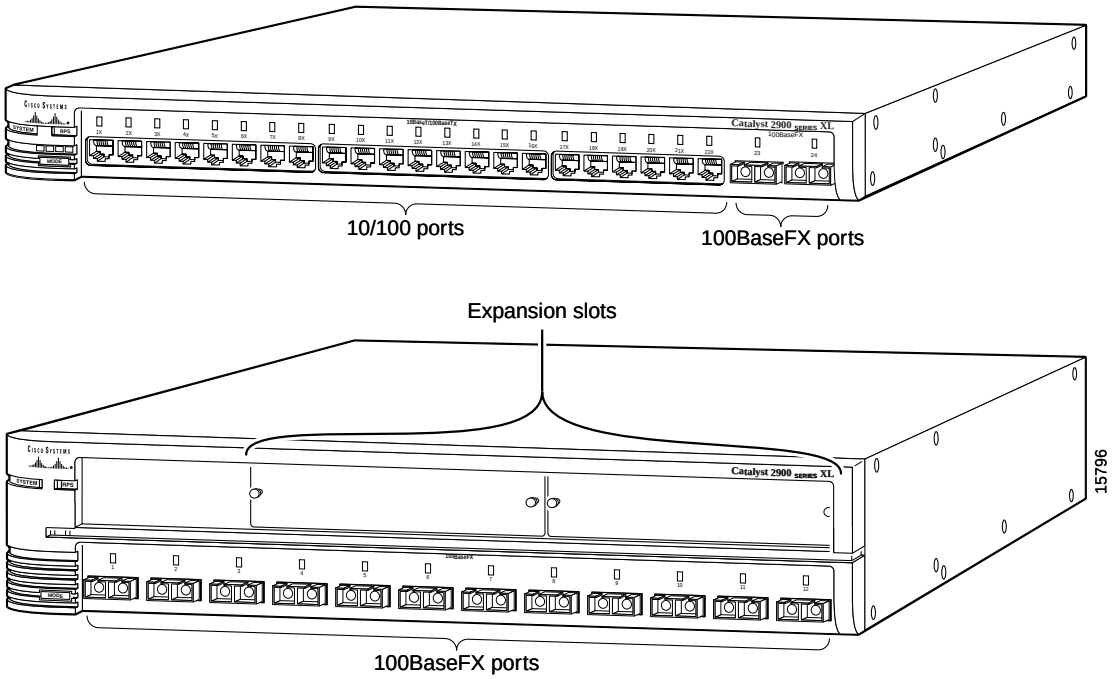
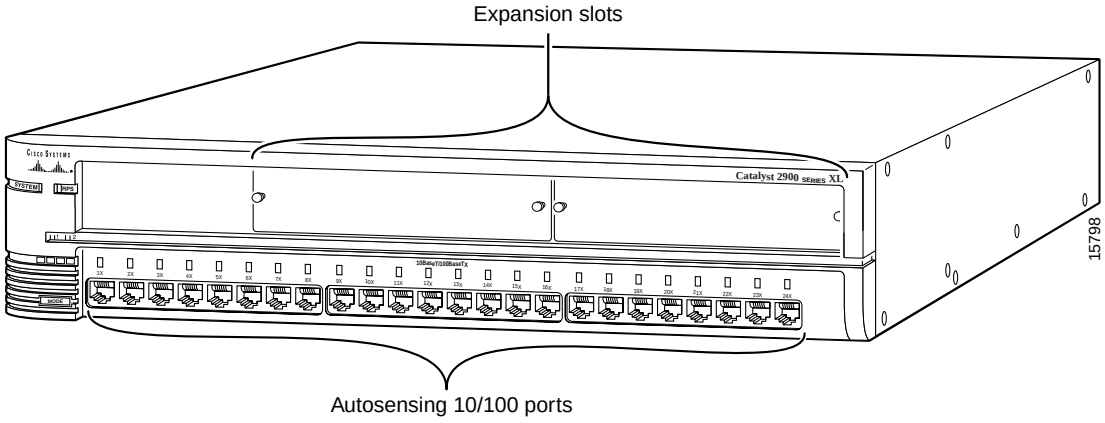


Figure 1-3 Catalyst 2924M XL



LEDs

You can use the switch LEDs to monitor switch activity and check performance. Figure 1-4 and Figure 1-5 show the location of the LEDs and the Mode button used to select one of the port modes. Changing a port mode changes the information provided by each port LED.

All of the LEDs described in this section, with the exception of the utilization meter (UTL), are visible on the Cisco Visual Switch Manager Home page and on the Cisco Visual Stack page. See the “Using the Manager Software” section on page 4-5 for more information on monitoring a single switch. The “Displaying the Cisco Visual Stack” section on page 5-13 describes how to display the LEDs for up to four Catalyst 2900 series switches.

Figure 1-4 Fixed-Port Switch LEDs

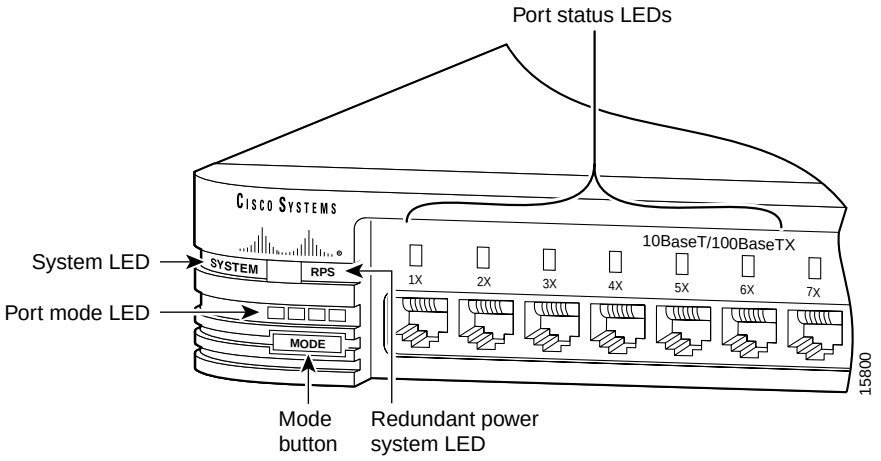
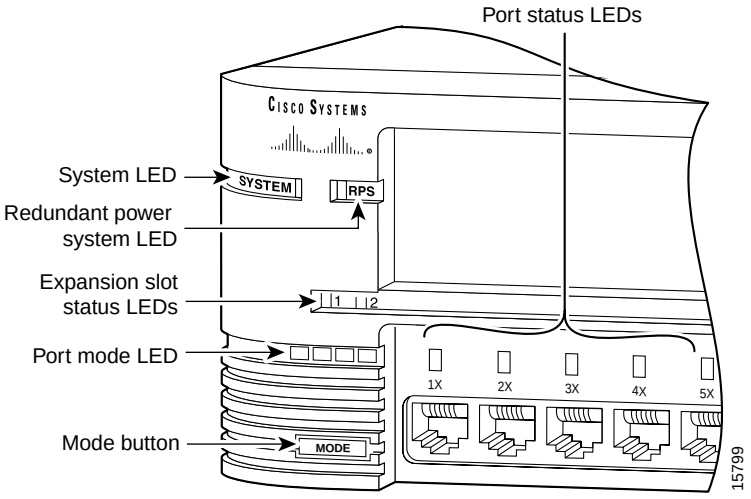


Figure 1-5 Modular Switch LEDs



System LED

The system LED shows whether the system is receiving power and functioning properly. Table 1-3 lists the LED colors and their meanings.

Table 1-3 System LED

Color	System Status
Off	System is not powered up.
Green	System is operating normally.
Amber	System is receiving power but is not functioning properly.

RPS LED

The redundant power system (RPS) LED shows the RPS status. Table 1-4 lists the LED colors and their meanings.

Table 1-4 RPS LED

Color	RPS Status
Off	RPS is off or is not installed.
Green	RPS is operational.
Blinking green	The RPS and the switch AC power supply are *both* powered up. If the switch power supply fails, the switch powers down and after 15 seconds restarts using power from the RPS. The switch goes through its normal boot sequence when it restarts.
Amber	RPS is connected but not functioning properly. One of the power supplies in the RPS could be powered down or a fan on the RPS could have failed.

Port Mode and Port Status LEDs

Use the Mode button to change the meanings of the LEDs above each port. There are four possible modes:

STAT	The port status. This is the default mode.
UTL	The current bandwidth in use by the switch.
FDUP	The port duplex mode: full duplex or half duplex.
100	The port operating speed: 10 or 100 Mbps.

See Table 1-5 for a description of the LED colors and their meanings for the different modes.

Changing the Port Mode

To change the port mode, press the Mode button (see Figure 1-6) to highlight in sequence each of the possibilities. Release the button to enable the lit function.

Figure 1-6 Changing the Port Mode

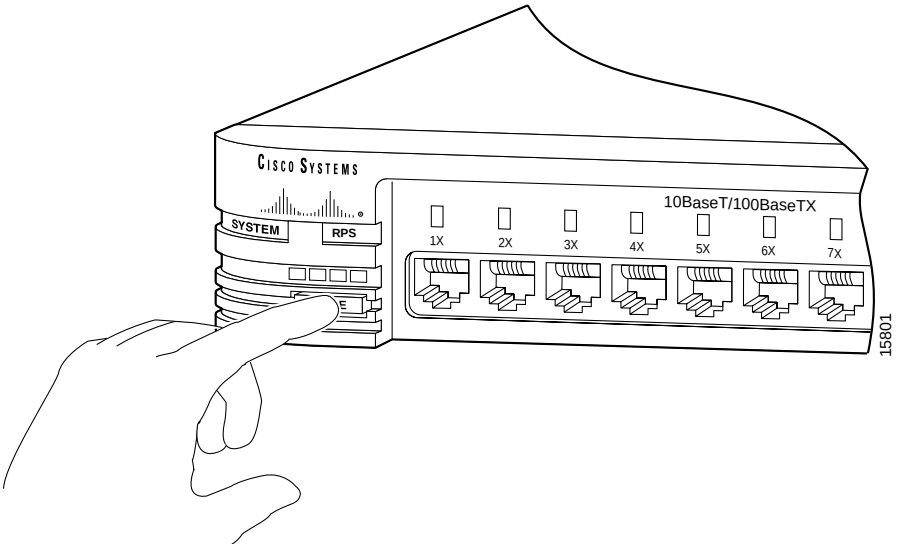
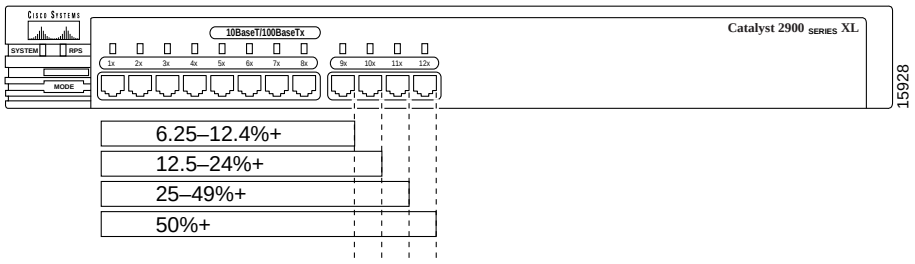


Table 1-5 Port Status LEDs by Mode

Port Mode	Color	Meaning
STAT (port status)	Off	No link.
	Solid green	Link present.
	Flashing green	Activity; port is transmitting or receiving data.
	Alternating green-amber	Link fault. Error frames can affect connectivity, and errors such as excessive collisions, CRC errors, and alignment and jabber errors are monitored for a link-fault indication.
	Solid amber	Port is not forwarding. Port was disabled by management or an address violation or blocked by Spanning-Tree Protocol (STP). **Note** After a port is reconfigured, the port status LED can remain amber for up to 30 seconds as STP checks the switch for possible loops.
UTL (utilization)	Green	The LEDs display backplane utilization on a logarithmic scale. If all port status LEDs are green, the switch is using 50% or more of its total bandwidth capacity. If the right-most LED is off, the switch is using less than 50% of its total bandwidth. If the LED to the left of the right-most LED is off, the switch is using less than 25% of its total capacity, and so on. Figure 1-7 shows the utilization expressed by the right-most LEDs.
FDUP (full duplex	Off	Port is operating in half duplex.
	Green	Port is operating in full duplex.
100 (speed)	Off	Port is operating at 10 Mbps.
	Green	Port is operating at 100 Mbps.

Figure 1-7 Catalyst 2900 Series XL Utilization Meter



Expansion Slot LEDs

The expansion slot LEDs show the status of installed modules. The LEDs are numbered 1 (left slot) and 2 (right slot). Table 1-6 lists the LED colors and their meanings.

Table 1-6 Expansion Slot LEDs

Color	Expansion Slot Status
Off	No module is installed.
Green	Module is operating normally.
Amber	Module failed POST and should be replaced.

Rear-Panel Description

The rear panels (see Figure 1-8 and Figure 1-9) have an AC power connector, a redundant power system (RPS) connector, an RJ-45 console port, and fans.

Power Connectors

You can provide power to the switch either by using the internal power supply or by connecting the Cisco RPS to the RPS connector on the switch.

If you want to use the internal power supply, an autoranging unit supporting input voltages between 100 and 240 VAC, use the supplied AC power cord to connect the AC power connector to an AC power outlet.

Warning Attach only the Cisco RPS (model PWR600-AC-RPS) to the RPS connector.

Console Port

You can connect a Catalyst 2900 series switch to a PC or terminal via the console port and the supplied rollover cable. For the data characteristics of the console port, see the “Connecting a Terminal or PC to the Console Port” section on page 3-17.

Figure 1-8 Rear Panel: Catalyst 2912 XL, Catalyst 2924 XL, and Catalyst 2924C XL

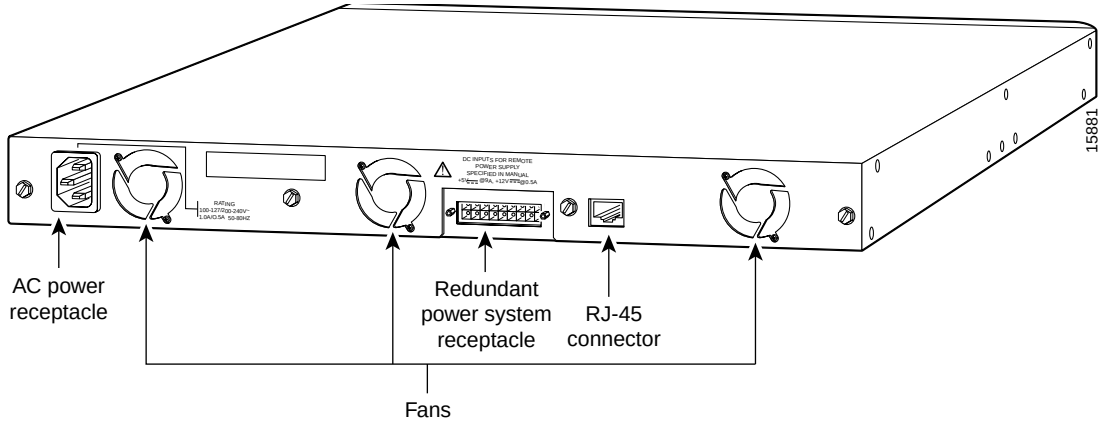
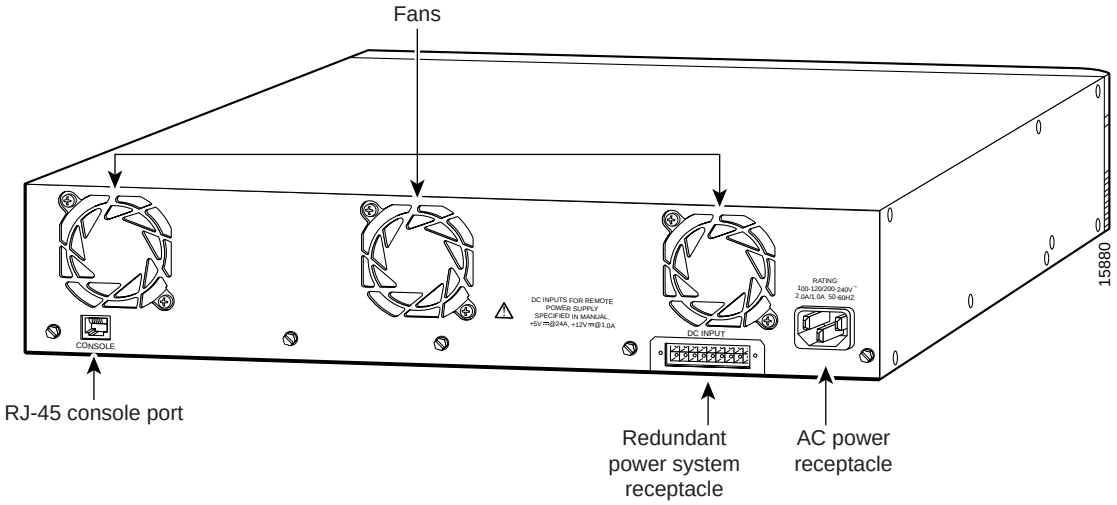


Figure 1-9 Rear Panel: Catalyst 2924M XL and Catalyst 2912MF XL



Catalyst 2900 Series XL Management Options

The switch offers the following management options:

- Cisco Visual Switch Manager software and Switch Network View
- Cisco IOS CLI
- CiscoView application
- SNMP network management platforms

Cisco Visual Switch Manager Software

The web-based Cisco Visual Switch Manager Software provides access to the switch through a browser. Using the manager software, you can configure the switch through the graphical user interface, monitor a *live* image of the switch, and display statistics.

The Cisco Switch Network View, hereafter referred to as the network view, displays a map of up to four Catalyst 2900 series XL switches and the devices connected to them. The network view shows the kinds of links between the devices and can display reports about each link and device. The Cisco Visual Stack displays real-time images of up to four Catalyst 2900 series XL switches.

Cisco IOS Command-Line Interface

You can access the Cisco IOS CLI by connecting a PC or terminal to the console port on the rear panel or by using Telnet. Instructions for using the CLI are in the Chapter 6, “Cisco IOS Management” chapter.

CiscoView Application

The CiscoView device-management application displays an image of the switch. You can point and click on the image to set configuration parameters and get statistics about the switch and its performance. CiscoView runs as a stand-alone application or as part of an SNMP network-management platform.

SNMP Network Management Platforms

You can also manage switches by using an SNMP-compatible management station running such platforms as HP OpenView and SunNet Manager. The switch supports a comprehensive set of MIB extensions and MIB II, the IEEE 802.1D bridge MIB, and four Remote Monitoring (RMON) groups.

Deployment Strategies

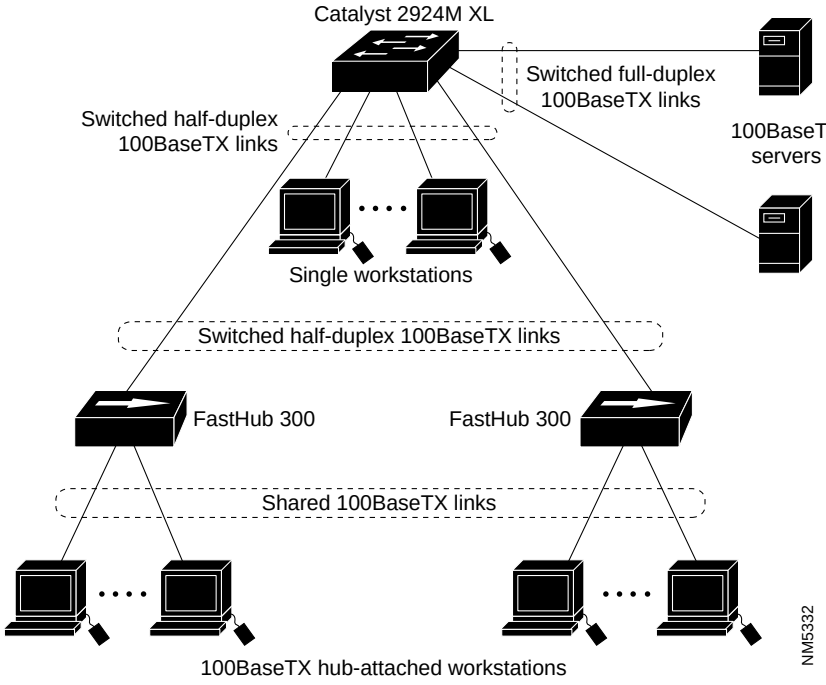
This section describes four examples of how you could deploy these switches in your network.

- High-performance client/server workgroup
- Wiring closet aggregator
- Power workgroup
- Star topology stack

High-Performance Client/Server Workgroup

Figure 1-10 shows a Catalyst 2924M XL switch connecting workstations, 100BaseTX hubs, and servers in a topology suited to client/server applications. The links to the 100BaseTX servers and workstations can be full duplex. A repeater does not support full-duplex transmission, so the links to the 100BaseTX repeaters are always half duplex.

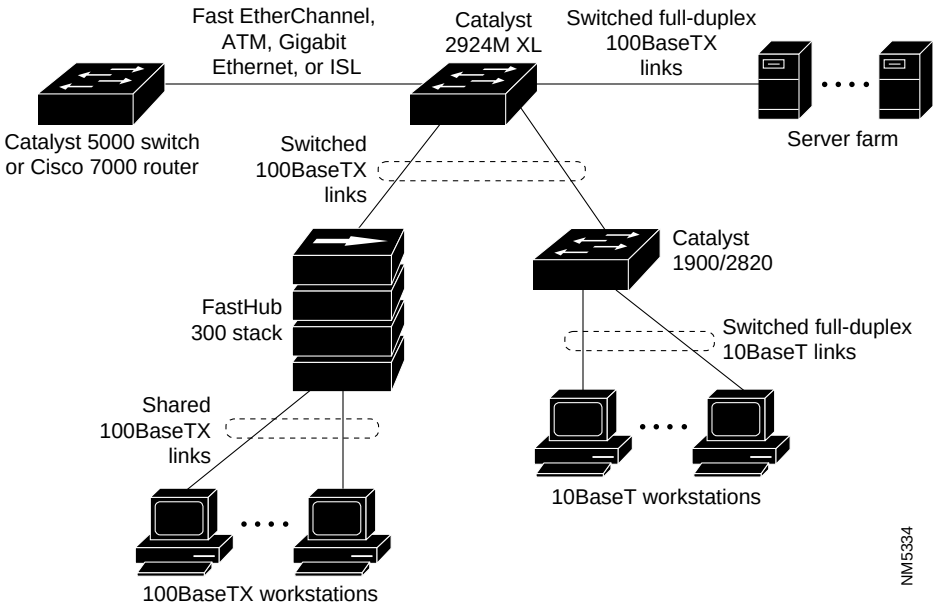
Figure 1-10 Catalyst 2924M XL in a High-Performance Client/Server Workgroup



Wiring Closet Aggregator

Figure 1-11 shows a Catalyst 2924M XL switch connecting 100BaseTX and 10BaseT devices. In this topology, the switch is in the middle of the network and can provide connectivity to any mixture of hubs, switches, and servers.

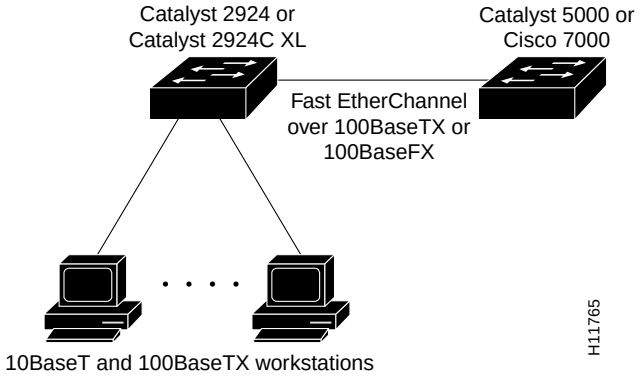
Figure 1-11 Catalyst 2924M XL in a Wiring Closet



Power Workgroup

Figure 1-12 shows a Catalyst 2924C XL or 2924 XL with a 100BaseT uplink and 10/100 connections to individual workstations.

Figure 1-12 Catalyst 2924C XL or Catalyst 2924 XL in a Power Workgroup Configuration



Star Topology Stack

Figure 1-13 shows four Catalyst 2900 series XL switches in a star topology. You can manage the switches in this topology as a single entity by using the manager software and the network view. Figure 1-13 shows the four switches connecting desktops, a Cisco router, and a Catalyst 5000 switch. For more information about managing a stack of several Catalyst 2900 series switches, see the “Chapter 5, “Switch Network View Software.”

Figure 1-13 Catalyst 2924M XL in a Star Topology Stack